REMOTE OPERATION SYSTEM AND REMOTE OPERATION METHOD THEREOF

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a remote operation system which realizes remote operation of an information processing device from another information processing device through a communication network, a remote operation method thereof and a recording medium which records a remote operation program.

DESCRIPTION OF THE RELATED ART

In conventional electronic computer systems, a remote operation system has been widely used in which a server is operated from an external terminal through a communication network.

This remote operation enables users to freely operate a computer and an apparatus located at places remote from the users and also enables numbers of users to share a high-performance server and operate a server from a plurality of terminals (or unspecified number of terminals connected to a communication network).

In addition, in the conventional remote operation systems, a server on the side of receiving remote operation is provided with a function of receiving user's log-in and operation through a network, while a terminal on the side of conducting remote operation is

provided with virtual terminal software or a terminal emulator for remote operation in order to realize remote operation.

Among virtual terminal software for conducting remote operation of a server from an external terminal is, for example, telnet. Telnet is the software intended for conducting remote operation through a CUI (character based user interface) which is a system for entering instruction commands as characters. In the software, with a computer on which such operating system as UNIX adapted to operation by CUI runs as a target of remote operation, an operation screen in the CUI environment on the computer to be operated is displayed at a terminal located on a user's side and the user enters a command into the operation screen, thereby realizing remote operation.

As described in the foregoing, in a remote operation system in the CUI environment, an operation screen in the CUI environment of a computer to be operated is displayed as the whole or one frame of a display of a terminal, a command input by a user is executed at the computer to be operated and a response corresponding to the execution and the like are displayed on the operation screen.

In recent years, there is a wide spread of computers having an operation environment for a GUI (graphical user interface) in which graphical elements

displayed on a screen such as an icon and a window are operated by a pointing device such as a mouse, and such computers having the GUI environment often fail to be adapted to such operation as input of an instruction

5   command in a CUI.

Even such computers in the GUI environment, however, can be remotely operated in the same manner as that in the CUI environment by providing a terminal on the side of conducting remote operation with virtual

10   terminal software adapted to the GUI environment.

Virtual terminal software in the GUI environment connects to a computer to be operated to obtain data of its display screen and displays the data in a display of a terminal. Then, when a user conducts GUI operation

15   such as clicking of a mouse within the display screen, the software instructs the computer to be operated to execute processing corresponding to the operation, thereby conducting remote operation.

This arrangement enables the display screen of

20   the computer to be operated to be displayed at a user's terminal and the computer to be operated to be remotely operated through operation of the GUI.

Among virtual terminal software adapted to the GUI environment are, for example, "Win Share" (product

25   of NEC Corp.), "Desktop On-Call" (product of IBM Japan, Ltd.) and "pcANYWHERE32" (product of Symantec Corporation). On the other hand, conventional techniques

of a remote operation systems which conduct remote operation of a computer having the GUI environment include the technique of the remote computer operation device disclosed in Japanese Patent Laying-Open (Kokai) No. Heisei 05-035622.

As described in the foregoing, conventional remote operation systems for a computer having the GUI environment have the following problems.

Firstly, conventional remote operation systems require that a terminal on the side of conducting remote operation should be provided with software for remote processing or such a special function of realizing the related function as a semiconductor circuit.

In addition, since a GUI environment of a computer to be operated varies with a kind of the computer or an OS (operating system) to be used, it is necessary to in advance adopt such virtual terminal software therefor as adapted to the computer to be operated.

Moreover, software or the like for remote operation by an GUI needs detailed and complicated setting at the time of installation etc., occupies much space in a hard disc and costs much in some cases. It is therefore troublesome to provide a terminal with such software.

Under these circumstances, users are not allowed to freely select a terminal for conducting remote

operation and need to use a special terminal having a function of remote operation adapted to a computer to be operated. For example, it was impossible to freely select an information processing terminal or a

5   communication terminal at hand to conduct remote operation.

One of conventional art for solving this problem is the remote operation method disclosed in Japanese Patent Laying-Open (Kokai) No. Heisei 10-301874.

10   In the conventional art disclosed in Japanese Patent Laying-Open No. Heisei 10-301874, automatic generation of a web page which displays image data of a display screen of a server as a computer to be operated leads to display of image of the display screen on a web

15   browser of a user's terminal.

As to operation by a user using a GUI, when the user executes such operation with image data of a display screen as clicking of a mouse, the use of Java applets for display of image data of a display screen

20   leads to automatic notification of the operation to a server side, whereby the server executes processing corresponding to the operation. Image of a display screen of the server which is displayed in a web browser of a user's terminal will be updated upon reception of

25   operation from the user or in other case.

Therefore, a user's terminal only needs to have a communication function such as the Internet and a web

browser and not a special function for remote operation.

Image data of a display screen of a computer, however, is of a considerably large volume and transmission of the data to a user's terminal to receive remote operation requires a high-speed communication line and a long communication time. While no special function is required of a user's terminal, a large volume of image data should be transmitted and received frequently for communication, which is not suitable for current communication infrastructure such as the Internet.

Secondly, in conventional remote operation systems, a terminal on the side of conducting remote operation needs to be provided with a display capable of displaying a display screen of a computer to be operated as it is.

For example, the terminals should be such information processing terminals having a broad display screen as a personal computer and a notebook-sized personal computer, and small-sized communication terminals including a cellular phone and a PHS (personal handy-phone system) are not capable of conducting remote operation of an external computer.

These communication terminals including a cellular phone and a PHS have their displays considerably small and allow a small number of colors to be displayed. Some of them are capable of displaying

characters only and not images and therefore are not allowed to display a screen of a computer as it is.

On the other hand, these portable communication terminals are now widespread among numbers of users and conveniently carried. Enabling use of such terminals for remote operation of an external computer will make them more useful.

SUMMARY OF THE INVENTION

A first object of the present invention is to provide a remote operation system which eliminates the above-described shortcomings of conventional art and enables small-sized portable communication terminals currently on the market such as a cellular phone and a PHS to conduct remote operation of an external computer by using a GUI and a remote operation method thereof, and a recording medium which records a remote operation program.

A second object of the present invention is to provide a remote operation system which eliminates the above-described shortcomings of conventional art and enables remote operation of an external computer using a GUI by freely using a portable communication terminal in user's hand without requiring a terminal on the side of conducting remote operation to have a special function for remote operation and a remote operation method thereof, and a recording medium which records a remote

operation program.

According to the first aspect of the invention, a remote operation system for remotely operating a device to be operated through a communication network from an operation side terminal, comprises

screen analysis means for analyzing information displayed on a screen of the device to be operated, and

screen information transmission means for transmitting data of an analysis result obtained by the screen analysis means to the operation side terminal to display the data on the operation side terminal.

In the preferred construction, the remote operation system further comprises operation execution means for causing the device to be operated to execute predetermined processing corresponding to user's operation conducted using the operation side terminal.

In another preferred construction, the remote operation system further comprises screen information conversion means for converting data of an analysis result obtained by the screen analysis means into data suitable for the transmission to the operation side terminal or for displaying on a screen of the operation side terminal, wherein

the screen information transmission means transmits data of a result of conversion by the screen information conversion means to the operation side terminal to display the data on the operation side

terminal.

In another preferred construction, the remote operation system further comprises conversion rule registration means for registering and recording rules for converting data of an analysis result obtained by the screen analysis means into data suitable for the transmission to the operation side terminal or for displaying on the screen of the operation side terminal, wherein

the screen information conversion means converts data of an analysis result obtained by the screen analysis means based on the conversion rules recorded in the conversion rule registration means.

In another preferred construction, the remote operation system further comprises device characteristic detection means for detecting device characteristics of the operation side terminal, wherein

the screen information conversion means converts data of an analysis result obtained by the screen analysis means based on device characteristics detected by the device characteristic detection means and conversion rules recorded in the conversion rule registration means.

In another preferred construction, the remote operation system further comprises screen change detection means for detecting a change in display of the screen of the device to be operated, wherein

at a time when a change occurred in display of the screen is completed, the screen analysis means analyzes the current screen of the device to be operated.

In another preferred construction, the device to be operated is an information processing device having a GUI, and the screen analysis means detects GUI widgets displayed on the screen of the device to be operated to obtain attribute data of the GUI widgets.

In another preferred construction, the attribute data of the GUI widgets includes at least one of a kind of the GUI widgets, a name of the GUI widgets and a location of the GUI widgets in the screen.

In another preferred construction, the conversion rule registration means has registration of rules for converting data of an analysis result obtained by the screen analysis means into a web page that can be displayed by a web browser,

the screen information conversion means converts data of an analysis result obtained by the screen analysis means into a web page based on the rules,

the web page includes, for GUI widgets operable by a user among GUI widgets detected by the screen analysis means, a hyper-link corresponding to the GUI widgets in question, and

when the hyper-link is selected, data for identifying GUI widgets corresponding to the hyper-link in question and data for identifying operation for the

GUI widgets in question are transmitted to the operation execution means.

In another preferred construction, the conversion rule registration means has registration of rules for converting data of an analysis result obtained by the screen analysis means into a text of electronic mail.

In another preferred construction, the operation execution means receives electronic mail including information of user's operation conducted using the operation side terminal, analyzes the received electronic mail to identify the user's operation, and executes the operation in question.

In another preferred construction, data of an analysis result obtained by the screen analysis means is data of an XML format.

In another preferred construction, the operation side terminal is a portable communication terminal having a character data transmission and reception function.

In another preferred construction, the communication network is the Internet.

In another preferred construction, the screen analysis means, when moving picture or still picture is displayed on the screen of the device to be operated, detects the display in question to extract picture data of the display in question, and

the screen information transmission means

transmits the picture data extracted by the screen
analysis means to the operation side terminal to display
the data on the operation side terminal.

In another preferred construction, the screen

5   analysis means, when moving picture or still picture is
displayed on the screen of the device to be operated,
detects the display in question to extract picture data
of the display in question, and

the screen information conversion means converts

10 the picture data extracted by the screen analysis means
into data suitable for the transmission to the operation
side terminal or for displaying on the screen of the
operation side terminal.

In another preferred construction, device

15 characteristics of the operation side terminal detected
by the device characteristic detection means include at
least one of an inherent ID of the operation side
terminal, a kind of machine, a processing rate, a
communication rate, communication costs per unit volume

20 of data, communication costs per unit time, a data
format that can be displayed on a screen, a playable
sound data format, executable program and script formats,
a volume of data receivable at one time, a color that
can be displayed, a character font that can be displayed,

25 a screen resolution, a physical length of a screen in a
vertical direction and a lateral direction and the
number of characters that can be displayed within one

screen in the vertical direction and the lateral direction.

According to the second aspect of the invention, a remote operation system for remotely operating a device to be operated through a communication network from an operation side terminal, wherein

the device to be operated comprises

screen analysis means for analyzing the contents displayed on a screen of the device to be operated, and

screen information transmission means for transmitting data of an analysis result obtained by the screen analysis means to the operation side terminal to display the data on the operation side terminal.

In the preferred construction, the remote operation system further comprises operation execution means for causing the device to be operated to execute predetermined processing corresponding to user's operation conducted using the operation side terminal.

In another preferred construction, the remote operation system further comprises screen information conversion means for converting data of an analysis result obtained by the screen analysis means into data suitable for the transmission to the operation side terminal or for displaying on a screen of the operation side terminal, wherein

the screen information transmission means transmits data of a result of conversion by the screen

information conversion means to the operation side
terminal to display the data on the operation side
terminal.

In another preferred construction, the remote
operation system further comprises conversion rule
registration means for registering and recording rules
for converting data of an analysis result obtained by
the screen analysis means into data suitable for the
transmission to the operation side terminal or for
displaying on the screen of the operation side terminal,
wherein

the screen information conversion means converts
data of an analysis result obtained by the screen
analysis means based on the conversion rules recorded in
the conversion rule registration means.

In another preferred construction, the remote
operation system further comprises device characteristic
detection means for detecting device characteristics of
the operation side terminal, wherein

the screen information conversion means converts
data of an analysis result obtained by the screen
analysis means based on device characteristics detected
by the device characteristic detection means and
conversion rules recorded in the conversion rule
registration means.

In another preferred construction, the remote
operation system further comprises screen change

detection means for detecting a change in display of the screen of the device to be operated, wherein

at a time when a change occurred in display of the screen is completed, the screen analysis means analyzes the current screen of the device to be operated.

In another preferred construction, the device to be operated is an information processing device having a GUI, and the screen analysis means detects GUI widgets displayed on the screen of the device to be operated to obtain attribute data of the GUI widgets.

In another preferred construction, the attribute data of the GUI widgets includes at least one of a kind of the GUI widgets, a name of the GUI widgets and a location of the GUI widgets in the screen.

In another preferred construction, the conversion rule registration means has registration of rules for converting data of an analysis result obtained by the screen analysis means into a web page that can be displayed by a web browser,

the screen information conversion means converts data of an analysis result obtained by the screen analysis means into a web page based on the rules,

the web page includes, for GUI widgets operable by a user among GUI widgets detected by the screen analysis means, a hyper-link corresponding to the GUI widgets in question, and

when the hyper-link is selected, data for

identifying GUI widgets corresponding to the hyper-link in question and data for identifying operation for the GUI widgets in question are transmitted to the operation execution means.

In another preferred construction, the conversion rule registration means has registration of rules for converting data of an analysis result obtained by the screen analysis means into a text of electronic mail.

In another preferred construction, the operation execution means receives electronic mail including information of user's operation conducted using the operation side terminal, analyzes the received electronic mail to identify the user's operation, and executes the operation in question.

In another preferred construction, data of an analysis result obtained by the screen analysis means is data of an XML format.

In another preferred construction, the operation side terminal is a portable communication terminal having a character data transmission and reception function.

In another preferred construction, the communication network is the Internet.

In another preferred construction, the screen analysis means, when moving picture or still picture is displayed on the screen of the device to be operated, detects the display in question to extract picture data

of the display in question, and

the screen information transmission means transmits the picture data extracted by the screen analysis means to the operation side terminal to display the data on the operation side terminal.

In another preferred construction, the screen analysis means, when moving picture or still picture is displayed on the screen of the device to be operated, detects the display in question to extract picture data of the display in question, and

the screen information conversion means converts the picture data extracted by the screen analysis means into data suitable for the transmission to the operation side terminal or for displaying on the screen of the operation side terminal.

In another preferred construction, device characteristics of the operation side terminal detected by the device characteristic detection means include at least one of an inherent ID of the operation side terminal, a kind of machine, a processing rate, a communication rate, communication costs per unit volume of data, communication costs per unit time, a data format that can be displayed on a screen, a playable sound data format, executable program and script formats, a volume of data receivable at one time, a color that can be displayed, a character font that can be displayed, a screen resolution, a physical length of a screen in a

vertical direction and a lateral direction and the number of characters that can be displayed within one screen in the vertical direction and the lateral direction.

According to the third aspect of the invention, a remote operation method of remotely operating a device to be operated through a communication network from an operation side terminal comprises

a screen analysis step of analyzing information displayed on a screen of the device to be operated, and

screen information transmission step of transmitting data of an analysis result obtained by the screen analysis step to the operation side terminal to display the data on the operation side terminal.

In the preferred construction, the remote operation method further comprises an operation execution step of causing the device to be operated to execute predetermined processing corresponding to user's operation conducted using the operation side terminal.

In another preferred construction, the remote operation method further comprises a screen information conversion step of converting data of an analysis result obtained by the screen analysis step into data suitable for the transmission to the operation side terminal or for displaying on a screen of the operation side terminal, wherein

at the screen information transmission step, data

of a result of conversion by the screen information

conversion step is transmitted to the operation side

terminal to display the data on the operation side

terminal.

5   In another preferred construction, the remote

operation method further comprises a conversion rule

registration step of registering rules for converting

data of an analysis result obtained by the screen

analysis step into data suitable for the transmission to

10 the operation side terminal or for displaying on the

screen of the operation side terminal, wherein

     at the screen information conversion step, data

of an analysis result obtained by the screen analysis

step is converted based on the conversion rules

15 registered at the conversion rule registration step.

     In another preferred construction, the remote

operation method further comprises a device

characteristic detection step of detecting device

characteristics of the operation side terminal, wherein

20   at the screen information conversion step, data

of an analysis result obtained by the screen analysis

step is converted based on device characteristics

detected by the device characteristic detection step and

conversion rules registered at the conversion rule

25 registration step.

     In another preferred construction, the remote

operation method further comprises a screen change

detection step of detecting a change in display of the screen of the device to be operated, wherein

at a time when a change occurred in display of the screen is completed, the contents displayed on the current screen of the device to be operated are analyzed by the screen analysis step.

In another preferred construction, the device to be operated is an information processing device having a GUI, and

at the screen analysis step, GUI widgets displayed on the screen of the device to be operated is detected to obtain attribute data of the GUI widgets.

In another preferred construction, the attribute data of the GUI widgets includes at least one of a kind of the GUI widgets, a name of the GUI widgets and a location of the GUI widgets in the screen.

In another preferred construction, at the conversion rule registration step, rules are registered for converting data of an analysis result obtained by the screen analysis step into a web page that can be displayed by a web browser,

at the screen information conversion step, data of an analysis result obtained by the screen analysis step is converted into a web page based on the rules,

the web page includes, for GUI widgets operable by a user among GUI widgets detected by the screen analysis step, a hyper-link corresponding to the GUI

widgets in question, and

at the operation execution step, using data for identifying GUI widgets corresponding to the hyper-link in question and data for identifying operation for the GUI widgets in question which are transmitted when the hyper-link is selected, the operation side terminal is caused to execute predetermined processing.

In another preferred construction, at the conversion rule registration step, rules are registered for converting data of an analysis result obtained by the screen analysis step into a text of electronic mail.

In another preferred construction, at the screen analysis step, when moving picture or still picture is displayed on the screen of the device to be operated, the display in question is detected to extract picture data of the display in question, and

at the screen information transmission step, the picture data extracted by the screen analysis step is transmitted to the operation side terminal to display the data on the operation side terminal.

In another preferred construction, at the screen analysis step, when moving picture or still picture is displayed on the screen of the device to be operated, the display in question is detected to extract picture data of the display in question, and

at the screen information conversion step, the picture data extracted by the screen analysis step is

converted into data suitable for the transmission to the operation side terminal or for displaying on the screen of the operation side terminal.

In another preferred construction, device characteristics of the operation side terminal detected by the device characteristic detection step include at least one of an inherent ID of the operation side terminal, a kind of machine, a processing rate, a communication rate, communication costs per unit volume of data, communication costs per unit time, a data format that can be displayed on a screen, a playable sound data format, executable program and script formats, a volume of data receivable at one time, a color that can be displayed, a character font that can be displayed, a screen resolution, a physical length of a screen in a vertical direction and a lateral direction and the number of characters that can be displayed within one screen in the vertical direction and the lateral direction.

According to another aspect of the invention, a remote operation program for remotely operating a device to be operated through a communication network from an operation side terminal by controlling an information processing system, which causes execution of

screen analysis processing of analyzing information displayed on a screen of the device to be operated, and

screen information transmission processing of transmitting data of an analysis result obtained by the screen analysis processing to the operation side terminal to display the data on the operation side terminal.

Other objects, features and advantages of the present invention will become clear from the detailed description given herebelow.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood more fully from the detailed description given herebelow and from the accompanying drawings of the preferred embodiment of the invention, which, however, should not be taken to be limitative to the invention, but are for explanation and understanding only.

In the drawings:

Fig. 1 is a block diagram showing a structure of a remote operation system according to a first embodiment of the present invention;

Fig. 2 is a flow chart for use in explaining processing of remote operation according to the first embodiment of the present invention;

Fig. 3 is a flow chart for use in explaining processing of a screen analysis by a screen analysis unit of the first embodiment of the present invention;

Fig. 4 is a diagram showing one example of a

window displayed on a GUI screen of a computer;

Fig. 5 is a diagram showing an example of a GUI screen of the computer;

Fig. 6 is a diagram showing one example of a menu in a window;

Fig. 7 is a diagram showing one example of property information of GUI widgets in the first embodiment of the present invention;

Fig. 8 is a diagram showing one example of a coordinate value of GUI widgets;

Fig. 9 is a diagram showing one example of data generated by the screen analysis unit of the first embodiment of the present invention;

Fig. 10 is a diagram showing one example of display, on a terminal device, of the display screen of Fig. 6 analyzed by the screen analysis unit of the first embodiment of the present invention;

Fig. 11 is a diagram showing one example of a display screen obtained when connection to a computer to be operated in the first embodiment of the present invention is established;

Fig. 12 is a diagram showing one example of display, on the terminal device, of the display screen of Fig. 11 analyzed by the screen analysis unit of the first embodiment of the present invention;

Fig. 13 is a diagram showing a state where an icon of Fax is double-clicked on the screen of Fig. 11

to display a window of Fax;

Fig. 14 is a diagram showing one example of
display, on the terminal device, of the display screen
of Fig. 13 analyzed by the screen analysis unit of the
first embodiment of the present invention;

Fig. 15 is a diagram showing a state where a file
menu is clicked on the screen of Fig. 13 to display a
pull-down menu;

Fig. 16 is a diagram showing one example of
display, on the terminal device, of the display screen
of Fig. 15 analyzed by the screen analysis unit of the
first embodiment of the present invention;

Fig. 17 is a diagram showing a state where an
item of transmission is clicked on the screen of Fig. 15
to display a window of Fax transmission;

Fig. 18 is a diagram showing one example of
display, on the terminal device, of the display screen
of Fig. 17 analyzed by the screen analysis unit of the
first embodiment of the present invention;

Fig. 19 is a diagram showing a state where a file
in a list box is clicked and selected on the screen of
Fig. 17;

Fig. 20 is a diagram showing one example of
display, on the terminal device, of the display screen
of Fig. 19 analyzed by the screen analysis unit of the
first embodiment of the present invention;

Fig. 21 is a diagram showing a state where a

window for entry of a Fax number which is the number of a Fax transmission destination is displayed;

Fig. 22 is a diagram showing one example of display, on the terminal device, of the display screen of Fig. 21 analyzed by the screen analysis unit of the first embodiment of the present invention;

Fig. 23 is a diagram showing a state where a window indicative of completion of Fax transmission is displayed;

Fig. 24 is a diagram showing one example of display, on the terminal device, of the display screen of Fig. 23 analyzed by the screen analysis unit of the first embodiment of the present invention;

Fig. 25 is a block diagram showing a structure of a remote operation system according to a second embodiment of the present invention;

Fig. 26 is a diagram showing one example of display, on the terminal device, of the display screen of Fig. 11 analyzed by the screen analysis unit of the second embodiment of the present invention;

Fig. 27 is a diagram showing one example of electronic mail transmitted to a computer from the terminal device of the second embodiment of the present invention;

Fig. 28 is a diagram showing one example of display, on the terminal device, of the display screen of Fig. 17 analyzed by the screen analysis unit of the

second embodiment of the present invention;

Fig. 29 is a diagram showing one example of display, on the terminal device, of the display screen of Fig. 21 analyzed by the screen analysis unit of the second embodiment of the present invention;

Fig. 30 is a diagram showing one example of electronic mail transmitted to the computer from the terminal device of the second embodiment of the present invention;

Fig. 31 is a block diagram showing a structure of a remote operation system according to a third embodiment of the present invention;

Fig. 32 is a block diagram showing a structure of a remote operation system according to a fourth embodiment of the present invention;

Fig. 33 is a diagram showing an example of a GUI screen of a computer to be operated in the fourth to sixth embodiments of the present invention;

Fig. 34 is a diagram showing one example of display, on a terminal device, of the display screen of Fig. 33 analyzed by a screen analysis unit of the fourth embodiment of the present invention and showing one example of display, on the terminal device, of the display screen of Fig. 33 converted by a screen information conversion unit of the sixth embodiment of the present invention;

Fig. 35 is a block diagram showing a structure of

a remote operation system according to a fifth
embodiment of the present invention;

Fig. 36 is a flow chart for use in explaining
processing of remote operation according to the fifth
embodiment of the present invention;

Fig. 37 is a diagram showing one example of data
generated by a screen analysis unit of the fifth
embodiment of the present invention;

Fig. 38 is a block diagram showing a structure of
a remote operation system according to the sixth
embodiment of the present invention;

Fig. 39 is a block diagram showing one specific
example of a device structure of the computer to be
operated of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the present invention
will be discussed hereinafter in detail with reference
to the accompanying drawings. In the following
description, numerous specific details are set forth in
order to provide a thorough understanding of the present
invention. It will be obvious, however, to those skilled
in the art that the present invention may be practiced
without these specific details. In other instance, well-
known structures are not shown in detail in order to
unnecessary obscure the present invention.

Fig. 1 is a block diagram showing a structure of

a remote operation system according to a first
embodiment of the present invention.

With reference to Fig. 1, in the remote operation
system of the first embodiment, a computer 100 is a

5   device to be remotely operated (operation target device),
a terminal device 101 is an operation side terminal
which is used by a user for remote operation, and the
computer 100 and the terminal device 101 are connected
through a communication network 102 to conduct

10   communication for remote operation.

The computer 100 is, for example, an information
processing device having a GUI operation environment.

The terminal device 101 is such a terminal
communicable through a communication network 102 as a

15   cellular phone or a PHS (personal handy-phone system)
and is for use in remote operation of the computer 100
by a user.

Similarly to cellular phones, PHSs and the like
on the market which are widely used in these days, the

20   terminal device 101 has a data communication function
and a display screen on which data can be displayed.

The communication network 102 is an information
communication line for the terminal device 101 of a user
and the computer 100 to be remotely operated to

25   communicate with each other for remote operation, for
which used are lines including dedicated lines for the
Internet, personal computer communication, the Internet

for i-mode and the like, and a telephone line and a
radio telephone line for the connection with these lines.

With reference to Fig. 1, the computer 100 to be
remotely operated includes a screen analysis unit 103, a
5   screen information transmission unit 104, a screen
change detection unit 105, an operation execution unit
106 and a communication unit 107.

The screen analysis unit 103 analyzes the
contents of a display screen of the computer 100 and
10 outputs an analysis result.

The screen information transmission unit 104
transmits screen information obtained as a result of an
analysis by the screen analysis unit to the terminal
device 101.

15 The communication unit 107 communicates with the
terminal device 101 through the communication network
102.

The operation execution unit 106 executes
processing designated by remote operation or gives an
20 instruction on the execution.

The screen change detection unit 105 detects a
change of a display screen of the computer 100.

Fig. 2 is a flow chart for use in explaining
processing of remote operation of the remote operation
25 system according to the first embodiment.

With reference to Fig. 2, in the remote operation
system of the first embodiment, first the computer 100

as a target of remote operation accepts connection from the terminal device 101 of a user (Step 201).

In addition, authenticate the user by accepting input of an ID number and a password for identifying a user or by other method (Step 202) and exclusively for users registered as a user allowed to conduct remote operation and properly authenticated, execute the subsequent communication for remote operation.

Then, the screen analysis unit 103 analyzes a display screen of the computer 100 to be operated (Step 203). In a case, for example, where the computer 100 is a personal computer (PC) or a work station (WS) having a GUI, the unit analyzes a current GUI screen to find what kind of object is being displayed and obtain data of a kind, a name, a location and the like of each object. Objects displayed on the GUI screen are GUI widgets such as a window, an icon, a menu and a button. In this analysis, employed is a method of obtaining data from an OS, for example.

Then, the data obtained by the screen analysis unit 103 is transmitted to the user's terminal device 101 by the screen information transmission unit 104 and displayed on a screen of the user's terminal device 101 (Step 204).

Then, when the user executes operation for the computer 100 by using the terminal device 101, the operation execution unit 106 receives information of the

operation and executes the operation on the computer 100
(Steps 205 and 206).

When these steps result in changing display of
the screen of the computer 100, the screen change

5   detection unit 105 detects the change. Upon detection of
the completion of the change, again execute the
processing at Step 203 and the following steps to update
data displayed on the screen of the user's terminal
device 101.

10   Next, detailed description will be made of an
analysis of the contents of the display screen of the
computer 100 conducted by the screen analysis unit 103.

Fig. 3 is a flow chart for use in explaining
processing of the screen analysis unit 103 of the

15   present embodiment.

The screen analysis unit 103 obtains information
such as a name and a display position of an icon
displayed and corresponding application from an OS of
the computer 100, for example. As a result, data of

20   various objects displayed in an icon and a window within
the screen can be precisely obtained from character data.

The present method of obtaining information can
be replaced by an OCR (optical character recognition)
method of simply converting image of a character

25   displayed on a screen into character data. The OCR
method of converting image into character data, however,
has the danger of conversion into inaccurate character

data and has such a disadvantage that a part of a window spreading out of the right or left side of a screen might not be read. By adopting the method of obtaining detailed information of each object from the OS of the computer 100, the screen analysis unit 103 of the first embodiment is allowed to spontaneously obtain accurate character data at any time without being affected by a resolution of image, a window display position or the like. This method is also employed for realizing an accessibility applied system which enables an information processing device having a GUI to be used by a user having visual or audio difficulty.

The screen analysis unit 103 of the first embodiment first detects a window being active (active window) among windows displayed on the current GUI screen of the computer 100 to obtain a title of the detected active window (Steps 301 and 302).

An active window is a window in a state of being ready for accepting input through a keyboard, while a title of a window is a character string assigned to the window (also called caption).

On a GUI screen, it is a common practice that a title of a window is displayed at an upper region of the window (called title bar). A title of a window 40 shown in Fig. 4, for example, is "to open file".

It is assumed in the first embodiment as in a common OS that when at least one window exists on a

screen, one active window exists.

Assume, for example, that on the current GUI screen of the computer 100, three windows 40 are displayed as shown in Fig. 5. Then, one of the three windows 40 is an active window and information of each window 40 is managed by the OS, whereby the screen analysis unit 103 detects the currently active window 40 by obtaining the information from the OS and similarly obtains information such as a title of the window.

In a case where no window 40 is displayed on a current GUI screen 50, a desktop which is the whole of a background region of a window or the like (entire screen) is considered to be currently an active window. Assume here that when the desktop is detected being an active window, a title of the active window is "desktop".

Upon detecting an active window displayed on the current GUI screen of the computer 100, the screen analysis unit 103 further obtains property information of such objects as a menu, an icon and a button (hereinafter, these objects will be generally referred to as GUI widgets) displayed on the active window (Step 303).

In the first embodiment, property information of GUI widgets represents a kind (menu, icon, button, etc.), a label (such a character string assigned to the GUI widgets as "OK" and "cancel" buttons, which is also called caption) and a coordinate value on the screen.

In a case, for example, where an active window displayed on the current GUI screen is a "memo pad" window 40 in which menu items 60 of "file", "edit", "format" and "tool" are displayed, the screen analysis unit 103 obtains property information of these four menu items 60 as shown in the example of Fig. 7. x1 to x4 and y1 to y4 in Fig. 7 all represent a certain positive integer.

Here, a coordinate value of GUI widgets on the screen can be expressed by coordinates at one point indicated by using distances from the upper left end point of the screen to the center (or the inside) of the GUI widgets in a lateral direction and a vertical direction.

This means that as illustrated in Fig. 8, when the window 40 exists on the desktop 50 and a GUI widget 80 is located on the window, coordinate values of the GUI widget are expressed as (x, y) by using a coordinate x in the lateral direction and a coordinate y in the vertical direction. Here, x and y are positive integers.

In a case where the active window 40 displayed on the current GUI screen of the computer 100 is the "memo pad" window shown in Fig. 6, the screen analyses unit 103 detects the active window 40 being the "memo pad" window to obtain the title of the window 40 (character string "memo pad") and further detects the four menu items 60 of the window 40 to obtain property information

of each menu item 60 as shown in Fig. 7. As a result,
data shown in Fig. 9 is obtained.

The above described analysis of a GUI screen by
the screen analysis unit 103 including detection of an
active window and acquisition of detailed and accurate
information of each kind of GUI widgets can be executed,
for example, by the technique recited in "Hidehiko Okada
and Toshiyuki Asahi: Tool 「GUI Tester 2」 for Evaluating
Consistency of GUI Design, Japanese Society of
Information Processing Engineers, Human Interface Study
Report, Vol. 97, No. 63, pp. 7-12, 1997).

Then, the screen analysis unit 103 outputs such
data as shown in Fig. 9 so as to have a predetermined
format to the screen information transmission unit 104
(Step 304). The predetermined format is a format that
can be displayed at the terminal device 101, which is
already known before remote operation is started by the
terminal device 101 in the first embodiment. The screen
information transmission unit 104 transmits the data
received from the screen analysis unit 103 to the
terminal device 101. As a result, the data output from
the screen analysis unit 103 (i.e. data including the
information of the GUI widgets displayed on the current
screen of the computer 100) is displayed on the terminal
device 101.

Assume, for example, that the terminal device 101
is provided with a web browser for displaying a web page

described with HTML (Hyper-Text Markup Language), so that a web page opened in a web site on a communication network such as the Internet can be displayed. In this case, the screen analysis unit 103 outputs data of a web page having the HTML format and the data is displayed on a screen of the terminal device 101, for example, as shown in Fig. 10. In the example of Fig. 10, first, "memo pad" which is a name of the active window is displayed and then an item name of each menu item 60 is displayed on each line as a hyper-link of HTML which can be selected on the screen of the terminal device 101.

The data file of the HTML format created by the screen analysis unit 103 and transmitted by the screen information transmission unit 104 is displayed on the screen of the terminal device 101 and upon operation on the screen (e.g. selection of a hyper-link), the operation information is transmitted to the operation execution unit 106 through the communication network 102 and the communication unit 107.

The operation execution unit 106 executes, on the computer 100, operation corresponding to the operation executed on the terminal device 101 based on the operation information transmitted from the terminal device 101 and the data of the screen analysis result output from the screen analysis unit 103.

When a hyper-link "file", which is one of menu item names 1000 displayed on the screen of the terminal

device 101 as shown in Fig. 10, for example, is selected, the operation execution unit 106 refers to coordinates corresponding to the relevant menu ((x1, y1) in Fig. 9) based on the data of the screen analysis result output

5 from the screen analysis unit 103 and moves a cursor of a pointing device such as a mouse to the coordinates in question on the screen of the computer 100 to notify the OS or the like of the execution of clicking at the relevant position.

10 Assume, for example, that in the example described above with reference to Figs. 6 to 10, the hyper-link "file" shown in Fig. 10 is selected on the screen of the terminal device 101. The operation execution unit 106 finds from the data received from the

15 screen analysis unit 103 that corresponding to the hyper-link "file" in Fig. 10 is the "file" menu 60 in Fig. 6 whose coordinate values are (x1, y1). Then, upon receiving information from the terminal device 101 that the hyper-link "file" of Fig. 10 is selected on the

20 screen of the terminal device 101, the operation execution unit 106 moves the cursor of a pointing device such as a mouse to the position of the coordinate values (x1, y1) and notifies the OS or the like of the execution of clicking at the position in question. As a

25 result, on the screen of the computer 100, the "file" menu 60 of Fig. 6 is selected on the screen of the computer 100.

When operation corresponding to the operation executed on the screen of the terminal device 101 is executed by the operation execution unit 106 on the computer 100, the screen change detection unit 105 detects a change of the GUI screen on the computer 100.

Change of the GUI screen on the computer 100 detected by the screen change detection unit 105 is, for example, opening of a new window, closing of a displayed window, displaying of a pull-down menu or the like.

At a time when no screen change is detected for more than a fixed time period, the screen change detection unit 105 determines that response of the computer 100 to the operation executed by the operation execution unit 106 is completed.

Upon determination of the completion of the response by the screen change detection unit 105, the screen analysis unit 103 again executes an analysis of the current GUI screen of the computer 100 to output data of screen information and the screen information transmission unit 104 transmits data of the screen information to the terminal device 101.

More specifically, when the user executes operation of selecting "file" which is one of the menu item names 1000 displayed on the terminal device 101, the execution is notified to the computer 100 to execute the processing of clicking "file" as the menu item 60, and screen information about a state where a pull-down

menu of "file" is displayed after the execution is transmitted as data of a displayable format to the terminal device 101, so that the screen of the user's terminal device 101 is updated to a screen having the new data displayed thereon.

Repetitious execution of the foregoing described processing as one cycle in the same manner hereinafter leads to execution of remote operation.

This cycle will be continued until communication from the terminal device 101 to the computer 100 is completed.

Next, one specific example of remote operation by the remote operation system according to the first embodiment will be described.

First, a user sets up a connection to the computer 100 as an operation target through the communication network 102 by using the terminal device 101 such as a cellular phone. Here, authentication of the user is conducted by a method of inputting an ID number or a password for identifying a user or by other method to start communication for remote operation from the terminal device 101 to the computer 100.

Fig. 11 is a diagram showing one example of the display screen 50 obtained at a time when a connection to the computer 100 as an operation target is established in the present embodiment. In the example of Fig. 11, three icons 1100, "memo pad, "schedule" and

"Fax" are displayed on the desktop and window is yet to be displayed.

The state of this display screen shown in Fig. 11 is analyzed by the screen analysis unit 103 of the computer 100. The screen analysis unit 103 obtains information such as a name and a display position of an icon displayed and a corresponding application from the OS of the computer 100 or by other method.

Then, the screen analysis unit 103 outputs the data of the screen information obtained by the analysis in a format which can be displayed on the terminal device 101 on the side of the user (e.g. as a web page described with HTML sentences) to the screen information transmission unit 104. The screen information transmission unit 104 transmits the received data to the terminal device 101.

Fig. 12 is a diagram showing one example of display, on the screen of the terminal device 101, of the information obtained by the analysis of the display screen shown in Fig. 11 and transmitted to the terminal device 101.

In the example of Fig. 12, since window for application is yet to be displayed on the display screen 50 of the computer 100, the indication of "desktop" indicating to that effect and a name of each icon 1000 displayed on the display screen 50 are displayed as a hyper-link.

Next, the user selects the icon name 1000
displayed on the terminal device 101. Here, description
will be made of a case where "Fax" is selected.

Then, the terminal device 101 notifies the
computer 100 of a request for data of a link destination
of "Fax" as a hyper-link and upon reception of the
request by the computer 100, the operation execution
unit 106 executes operation of double-clicking
coordinates on the GUI screen of the computer 100 output
from the screen analysis unit 103 for the icon 1100 of
"Fax" (i.e. coordinates on the icon 1100 of "Fax").

Since in the ordinary GUI environment, when an
icon on a desktop is double-clicked, processing
corresponding to the icon in question is executed,
execution of double-clicking is here set as operation
corresponding to an icon.

Fig. 13 is a diagram showing a state where a
window of Fax is displayed as a result of double-
clicking of the icon of Fax on the screen of Fig. 11.

On the screen of Fig. 13, the "Fax" window 40 is
displayed which is currently an active window. On the
window 40 of "Fax", the menu items 60 of "file" and
"setting" are displayed.

Here, the screen change detection unit 105
detects a change which is new indication of the window
40 within the screen 50 and upon determination of the
completion of the response because of detection of no

change on the screen more than a fixed time thereafter, instructs the screen analysis unit 103 to conduct an analysis of the screen.

Again, the screen analysis unit 103 analyzes the screen and outputs the analysis result as a web page of HTML, so that the web page is displayed on the screen of the terminal device 101.

Fig. 14 is a diagram showing one example of display, on the terminal device 101, of the information of the display screen shown in Fig. 13.

In display of the terminal device 101 shown in Fig. 14, first, Fax which is the name of an active window is displayed and then "file" and "setting" which are names of menu items of the window of Fax are displayed as hyper-links.

Here, when the user selects the menu item name 1000 of "file" as a hyper-link, the operation is similarly notified to the side of the computer 100, whereby the operation execution unit 106 executes the operation of clicking "file" as the menu item 60 on the GUI screen 50 of Fig. 13.

Fig. 15 shows a state where a pull-down menu is displayed as a result of clicking the menu item "file" on the screen of Fig. 13, in which pull-down menu displayed are three sub-menu items 1500, "open", "transmission" and "end".

In the same manner, the screen change detection

unit 105 detects a change of the GUI screen 50 caused by the display of this pull-down menu and upon determination of the completion of the response because of detection of no change in the screen more than a

5   fixed time period thereafter, instructs the screen analysis unit 103 to conduct an analysis of the screen.

      Again, the screen analysis unit 103 analyzes the screen and outputs the analysis result as a web page of HTML, so that the web page is displayed on the screen of

10   the terminal device 101.

      Fig. 16 is a diagram showing one example of display, on the terminal device 101, of the information of the display screen shown in Fig. 15.

      On the screen of Fig. 16, the names of the three

15   sub-menu items 1500, "open", "transmission" and "end" displayed in the pull-down menu of Fig. 15 are displayed as hyper-links.

      Here, when the user selects the sub-menu item name 1500 of "transmission" as a hyper-link, the

20   operation is similarly notified to the side of the computer 100, whereby the operation execution unit 106 executes the operation of clicking the sub-menu item 1500 "transmission" in the pull-down menu on the GUI screen 50 of Fig. 15.

25   Fig. 17 is a diagram showing a state where the window 40 for Fax transmission is displayed by clicking the item of "transmission" on the screen of Fig. 15, in

which the window 40 is currently an active window.

The "Fax transmission" window 40 has a list box 1700 for the selection of a file for use in transmission and buttons 1701 for giving instructions on the

5 transmission and cancellation. In the list box 1700, a list of files 1702 to be transmitted which are recorded in a folder designated by the user is displayed.

In the same manner, the screen change detection unit 105 detects a screen change caused by the display

10 of the "Fax transmission" window 40 and upon determination of the completion of the response because of detection of no change in the screen more than a fixed time period thereafter, instructs the screen analysis unit 103 to conduct an analysis of the screen.

15 Again, the screen analysis unit 103 analyzes the screen and outputs the analysis result as a web page of HTML, so that the web page is displayed on the screen of the terminal device 101.

Fig. 18 is a diagram showing one example of

20 display, on the terminal device 101, of the information of the display screen shown in Fig. 17.

On the screen of Fig. 18, displayed as hyper-links are the file 1702 indicated at each item in the list box 1700 shown in Fig. 17 and "OK" and "cancel" of

25 the buttons 1701.

Here, when the user selects "file2.dat" which is a hyper-link, the operation is similarly notified to the

side of the computer 100, whereby the operation
execution unit 106 executes the operation of clicking
"file2.dat" of the file 1702 displayed in the list box
1700 on the GUI screen 50 of Fig. 17.

5   Fig. 19 is a diagram showing a state where
"file2.dat" in the list box 1700 on the screen of Fig.
17 has its characters and color of the background
inversely displayed as a result of its clicking to
select the "file2. dat" file 1702.

10   In the same manner, the screen change detection
unit 105 detects a screen change caused by inverted
display of the item "file2.dat" in the list box 1700 and
upon determination of the completion of the response
because of detection of no change in the screen more
15   than a fixed time period thereafter, instructs the
screen analysis unit 103 to conduct an analysis of the
screen.

Again, the screen analysis unit 103 analyzes the
screen and outputs the analysis result as a web page of
20   HTML, so that the web page is displayed on the screen of
the terminal device 101.

Fig. 20 is a diagram showing one example of
display of the information of the display screen shown
in Fig. 19 on the terminal device 101.

25   On the screen of Fig. 20, the sign "+" attached
to the head of a file name represents that the file in
question is an item currently selected. In other words,

in the present embodiment, the screen analysis unit 103 outputs a web page of the HTML format with the sign "+" attached to the head of a hyper-link of an item currently selected in the list box.

5   Here, when the user selects the hyper-link 1000 indicative of the "OK" button, the operation is similarly notified to the side of the computer 100, whereby the operation execution unit 106 executes the operation of clicking the "OK" button 1701 of the "Fax

10   transmission" window 40 on the GUI screen 50 shown in Fig. 19.

Fig. 21 is a diagram showing a state where the window 40 for the entry of a Fax number as the number of a Fax transmission destination is displayed by clicking

15   the "OK" button 1701 on the screen of Fig. 19, in which the window 40 is currently an active window.

The window 40 for the entry of a Fax number has an entry box 2100 for the entry of a Fax number and buttons 1701, "OK" and "cancel".

20   In the same manner, the screen change detection unit 105 detects a screen change caused by the display of the window 40 for the entry of a Fax number and upon determination of the completion of the response because of detection of no change in the screen more than a

25   fixed time period thereafter, instructs the screen analysis unit 103 to conduct an analysis of the screen.

Again, the screen analysis unit 103 analyzes the

screen and outputs the analysis result as a web page of
HTML, so that the web page is displayed on the screen of
the terminal device 101.

Fig. 22 is a diagram showing one example of
display, on the terminal device 101, of the information
of the display screen shown in Fig. 21.

In Fig. 22, a character string entry box 2200 is
displayed corresponding to the character string entry
box 2100 of Fig. 21. More specifically, in the present
embodiment, when the character string entry box 2100
appears in an active window on the GUI screen 50 of the
computer 100, the screen analysis unit 103 outputs a web
page of the HTML format so as to display the character
string entry box 2200 corresponding to the box 2100 on
the screen of the terminal device 101. Since recent
cellular phone terminals, PHS terminals, etc. ordinarily
have a function of displaying the character string entry
box 2200 on a web browser screen for the entry of
characters, the present embodiment makes the use of this
function to display the character string entry box 2200.

Here, when the user inputs the Fax number into
the character string entry box 2200 and selects the
hyper-link 1000 indicative of the "OK" button, the
operation is similarly notified to the side of the
computer 100, whereby the operation execution unit 106
inputs the Fax number entered by the user into the
character string entry box 2100 on the GUI screen 50 of

Fig. 21 and further clicks the "OK" button 1701 on the window 40 in question.

As a result, the computer 100 accepts the remote operation for giving an instruction on Fax transmission from the user to transmit the contents of the file "file2.dat" to the transmission destination having the designated Fax number.

Fig. 23 is a diagram showing a state where in response to the entry of the Fax number and the instruction on transmission thereof on the screen of Fig. 21, the window 40 indicative of the completion of the transmission is displayed, in which the window 40 is currently an active window.

In the same manner, the screen change detection unit 105 detects a screen change caused by the display of the window 40 for the entry of the Fax number and upon determination of the completion of the response because of detection of no change in the screen more than a fixed time period thereafter, instructs the screen analysis unit 103 to conduct an analysis of the screen.

Again, the screen analysis unit 103 analyzes the screen and outputs the analysis result as a web page of HTML, so that the web page is displayed on the screen of the terminal device 101.

Fig. 24 is a diagram showing one example of display, on the terminal device 101, of the information

of the display screen shown in Fig. 23.

Then, when the user executes the operation for closing the window 40 which notifies the completion of Fax transmission (Fig. 23) by selecting the hyper-link 1000 indicative of the "OK" button, the operation execution unit 106 clicks the "OK" button 1701 on the window 40 on the GUI screen of the computer 100. The window 40 notifying the completion of the Fax transmission is responsively closed to return the GUI screen 50 of the computer 100 to the state shown in Fig. 13.

By the foregoing procedure, a series of operation of transmitting facsimile by remotely operating the computer 100 is completed.

Next, a remote operation system of a second embodiment of the present invention will be described.

In the first embodiment, it is known in advance that the terminal device 101 is a terminal device capable of displaying a web page of the HTML format, and data of screen information output by the screen analysis unit 103 to the screen information transmission unit 104 is a web page of the HTML format. On the other hand, in the second embodiment, it is known in advance that the terminal device 101 is a terminal device capable of transmitting and receiving electronic mail, and data of screen information output by the screen analysis unit 103 to the screen information transmission unit 104 is a

text of electronic mail.

Fig. 25 is a block diagram showing a structure of a remote operation system according to the second embodiment. The remote operation system of the second embodiment is completely the same in basic operation as the remote operation system of the first embodiment and is different only in that data for remote operation is transmitted and received not as a web page of HTML sentences but as electronic mail.

In a case where a display screen of the computer 100 is the display screen 50 shown in Fig. 11, for example, in the remote operation system of the second embodiment, a screen analysis unit 2500 analyzes the contents of the display screen 50 shown in Fig. 11 and outputs the result of the analysis as a text of electronic mail. A screen information transmission unit 2501 transmits the text of electronic mail to an electronic mail address of the terminal device 101. The terminal device 101 receives the electronic mail, which is displayed on the screen, for example, as shown in Fig. 26.

When a user looks at the screen of the electronic mail and wants to operate a "Fax" icon, for example, he or she will return such mail as shown in Fig. 27 in response to the received electronic mail having the screen shown in Fig. 26. In other words, he or she returns the mail with the number of an item to be

operated entered into a column of a main text.

When the electronic mail is thus returned from the terminal device, an operation execution unit 2502 receives the returned electronic mail and analyzes the column of the main text of the returned electronic mail to determine operation to be conducted, and executes the operation in the same manner as in the first embodiment (in a case of the example of the electronic mail shown in Fig. 27, to double-click coordinates on the "Fax" icon 1100 in Fig. 11). As a result, the display screen of the computer 100 will be changed into the display screen 50 shown in Fig. 13.

In a case where a display screen of the computer 100 is the display screen 50 shown in Fig. 17, for example, in the remote operation system of the second embodiment, the screen analysis unit 2500 analyzes the contents of the display screen 50 shown in Fig. 17 and outputs the result of the analysis as a text of electronic mail. The screen information transmission unit 2501 transmits the text of electronic mail to an electronic mail address of the terminal device 101. The terminal device 101 receives the electronic mail, which is displayed on the screen, for example, as shown in Fig. 28. When the user looks at the screen of the electronic mail and wants to select the "file2.dat" file, for example, he or she returns the same mail as that shown in Fig. 27 in response to the received electronic mail

having the screen shown in Fig. 28.

When the operation execution unit 2502 receives the returned electronic mail, the unit 2502 executes operation of clicking "file2.dat" of the file 1702

5 displayed within the list box 1700 on the GUI screen 50 of Fig. 17. As a result, the display screen of the computer 100 will be changed into the display screen 50 shown in Fig. 19.

In a case where a display screen of the computer

10 100 is the display screen 50 shown in Fig. 21, for example, in the remote operation system of the second embodiment, the screen analysis unit 2500 analyzes the contents of the display screen 50 shown in Fig. 21 and outputs the result of the analysis as a text of

15 electronic mail. The screen information transmission unit 2501 transmits the text of electronic mail to an electronic mail address of the terminal device 101. The terminal device 101 receives the electronic mail, which is displayed on the screen, for example, as shown in Fig.

20 29. When the user looks at the screen of the electronic mail and wants to enter a Fax number and select the "OK" button, he or she returns such mail as shown in Fig. 30 in response to the received electronic mail having the screen shown in Fig. 29.

25 Upon receiving the returned electronic mail, the operation execution unit 2502 enters the Fax number put in 1 of the main text of the received electronic mail

shown in Fig. 30 into the character string entry box 2100 on the GUI screen 50 of Fig. 21 and further clicks the "OK" button 1701 on the window 40. As a result, the display screen of the computer 100 will be changed into the display screen 50 shown in Fig. 23. The foregoing described remote operation system of the second embodiment enables small-sized portable communication terminals such as a cellular phone and a PHS to conduct remote operation of an external computer while referring to the contents of a display screen of the computer. The system also enables remote operation of an external computer by freely using a portable communication terminal or the like at a user's hand without requiring a terminal on the side of conducting remote operation to have a special function for remote operation.

Next, a remote operation system according to a third embodiment of the present invention will be described.

Fig. 31 is a block diagram showing a structure of the remote operation system according to the present embodiment.

Although the above-described remote operation systems of the first and second embodiments have been described assuming that a terminal on the side of conducting operation is such a terminal as a cellular phone or a PHS, the terminal is not limited thereto as long as it is such a terminal having a function of

transmitting and receiving character data as a web browser. In the present embodiment shown in Fig. 31, used as the terminal on the side of conducting operation is a computer 3100 which is a personal computer, a note-sized personal computer, or other information processing device.

The computer 3100, which is mounted with a Web browser, is capable of displaying data of the HTML format on a screen and also capable of displaying a GUI screen similarly to the computer 100 to be operated.

Since the remote operation system of the present embodiment is allowed to conduct remote operation using only a web browser etc., it requires a terminal on the side of conducting operation to be provided with none of special software, a semiconductor circuit or the like for remote operation unlike conventional remote operation systems.

Most of recent personal computers and note-sized personal computers are marketed with a web browser mounted thereon in advance. Therefore, these terminals can be used as the computer 3100 of the present embodiment without additionally providing special software.

Operation of the remote operation system according to the present embodiment is the same as that of the first embodiment. Data having the HTML format of screen information output by the screen analysis unit

103 is displayed on the screen of the computer 3100 and the operation execution unit 106 executes operation of the computer 100 according to operation executed on the computer 3100.

The above-described remote operation system of the present embodiment attains the same effects as obtained by the first embodiment also in a case where a computer is used as a terminal on the side of conducting operation.

Moreover, unlike a conventional remote operation system using a GUI in which a computer is used as a terminal on the side of conducting operation, the system of the present embodiment enables drastic reduction of communication costs because it is capable of conducting remote operation by transmitting only the minimum necessary data indicative of information of a screen of a computer to be operated.

In addition, in such a system having a terminal on the side of conducting operation provided with an image data displaying function as the present embodiment, a function may be provided of transmitting image data of the whole or a designated part (within a window of an application or the like) of a GUI screen of the computer 100 to be operated to the user's computer 3100 based on the user's instruction or predetermined setting. This enables detailed display contents of a GUI screen, which are unclear only with character data, to be displayed in

a web browser of the user's computer 3100 or the like for confirmation.

Next, a remote operation system according to a fourth embodiment of the present invention will be

5   described.

Fig. 32 is a block diagram showing a structure of the remote operation system according to the fourth embodiment. The remote operation system of the fourth embodiment is completely the same as the remote

10   operation system of the first embodiment in basic operation and is different only in operation of a screen analysis unit 3200 and a screen information transmission unit 3201. In the remote operation system according to the fourth embodiment, when still picture or moving

15   picture is displayed within an active window displayed on a current GUI screen of the computer 100, the screen analysis unit 3200 detects the picture. When detecting still picture or moving picture being displayed, the screen analysis unit 3200 furthermore extracts display

20   data of the still picture or the moving picture and outputs the data to the screen information transmission unit 3201 together with data of a web page in the HTML format. The screen information transmission unit 3201 transmits the data received from the screen analysis

25   unit 3200 to the terminal device 101.

Assume, for example, that the current screen of the computer 100 is the same as the screen 50 of Fig. 33.

It is also assumed that the picture display window 40 is currently an active window and in a picture display box 3300 on the picture display window 40, still picture such as a photograph or moving picture such as TV is displayed. In this case, the screen analysis unit 3200 detects the picture display window 40 being currently the active window and analyzes information of GUI widgets on the window to output data of a web page in the HTML format, as well as detecting the picture display box 3300 in which still picture or moving picture is displayed existing on the window 40 to extract and output picture data displayed in the picture display box 3300.

These pieces of data output by the screen analysis unit 3200 are transmitted to the terminal device 101 by the screen information transmission unit 3201 and as a result, these pieces of data are displayed on the screen of the terminal device 101 as shown in Fig. 34. The picture data displayed in the picture display box 3300 of Fig. 33 is displayed in a picture display box 3400 shown in Fig. 34. When the picture displayed in the picture display box 3300 is moving picture, the picture in the picture display box 3300 changes with time, according to which change, the picture in the picture display box 3400 also changes. In other words, when detecting moving display, the screen analysis unit 3200 continuously extracts data of picture in the

picture display box 3300 in which moving picture is displayed and continuously outputs the data to the screen information transmission unit 3201. The screen information transmission unit 3201 continuously transmits picture data of this moving picture to the picture display box 3400. In the present embodiment, the terminal device 101 is a terminal device capable of displaying the picture display box 3400 and also capable of displaying still picture or moving picture in the picture display box 3400.

Next, a remote operation system according to a fifth embodiment of the present invention will be described.

Fig. 35 is a block diagram showing a structure of the remote operation system according to the fifth embodiment. With reference to Fig. 35, the remote operation system according to the fifth embodiment includes, in addition to the components of the remote operation system according to the first embodiment shown in Fig. 1, a screen information conversion unit 3502, a conversion rule registration unit 3505 and a terminal characteristic detection unit 3506.

The terminal characteristic detection unit 3506 detects terminal characteristics of the terminal device 101. Terminal characteristics are an ID inherent to a terminal device, a type of machine, a processing rate, a communication rate, a communication cost per unit volume

of data, a communication cost per unit time, a data format that can be displayed on a screen, a playable sound data format, executable program and script formats, a volume of data receivable at one time, a color that can be displayed, a character font that can be displayed, a screen resolution, physical lengths of a screen in vertical and lateral directions, the number of characters that can be displayed in the vertical and lateral directions in one screen, and the like.

The screen information conversion unit 3502 converts data of a result of a screen analysis obtained by the screen analysis unit 3501 into data suitable for transmission to the terminal device 101 or display at the terminal device 101 taking terminal characteristics of the terminal device 101 detected by the terminal characteristic detection unit 3506 into consideration. Rules for the conversion are registered at the conversion rule registration unit 3505.

Fig. 36 is a flow chart for use in explaining processing of remote operation by the fifth embodiment of the present invention.

With reference to Fig. 36, the processing of the remote operation system according to the fifth embodiment is the same as that of the remote operation system according to the first embodiment up to authentication of a user (Step 202).

Upon completion of the authentication of a user,

the terminal characteristic detection unit 3506 detects characteristics of the terminal device 101 (Step 3601). Next, the screen analysis unit 3501 analyzes the current screen of the computer 3500 (Step 203, the same as that of the first embodiment). Then, the screen information conversion unit 3502 converts data of a result of the screen analysis obtained by the screen analysis unit 3501 (Step 3602). The converted data is transmitted to the terminal device 101 by the screen information transmission unit 3503 and displayed on the screen of the user's terminal 101 (Step 204).

Then, when the user executes operation for the computer 3500 by using the terminal device 101, the operation execution unit 3504 receives information of the operation and executes the operation on the computer 3500 (Steps 205 and 206).

When display of the screen of the computer 3500 is changed by this operation, the screen change detection unit 105 detects the change. Upon finding that the change is completed, again execute the processing at Step 203 and the following steps to update data displayed on the screen of the user's terminal device 101 to be the latest one.

Next, one specific example of remote operation by the remote operation system according to the fifth embodiment will be described.

The screen analysis unit 3501 analyzes the

display screen of the computer 3500 and outputs data of an analysis result in a general-purpose format independent of device characteristics of the terminal device 101, for example, the XML (extensible markup

5   language) format. Assume, for example, that one example of the display screen 50 of the computer 3500 is as shown in Fig. 11 similarly to the case of the one specific example of the remote operation in the first embodiment. Fig. 37 shows one example of data of screen

10   information of the XML format obtained by an analysis of the display screen 50 shown in Fig. 11 by the screen analysis unit 3501 and output to the screen information conversion unit 3052. In Fig. 37, x1 to x3 and y1 to y3 are values of an x coordinate and a y coordinate of the

15   three icons 1100 shown in Fig. 11. In Fig. 37, event tag represents an operation event, while LWCLICK represents double-click by a left button of the mouse.

In this example, the device characteristic detection unit 3506 detects an ID inherent to the

20   terminal device 101, and registered in the conversion result registration unit 3505 for each ID inherent to the terminal device 101 are rules for converting data of a general-purpose format output by the screen analysis unit 3501 into data of a format suitable for the

25   terminal device having the inherent ID in question. Assume, for example, that an inherent ID of the terminal device 101 is detected being Z and that rules for

converting data of screen information from the XML

format to the HTML format in a case of a terminal device

whose inherent ID is Z are registered at the conversion

rule registration unit 3505 (that is, in this case, the

5   terminal device 101 whose inherent ID is Z is a terminal

device capable of displaying data of the HTML format).

In this case, the screen information conversion unit

3502 converts the data of the screen information having

the XML format output by the screen analysis unit 3501

10   into data of the HTML format according to the conversion

rules for a terminal device whose inherent ID is Z which

are registered at the conversion rule registration unit

3505. The data of the HTML format is transmitted to the

terminal device 101 by the screen information

15   transmission unit 3503 and displayed on the screen of

the terminal device 101 similarly to the example of Fig.

12.

The operation execution unit 3504 receives

information of the operation conducted on the terminal

20   device 101 and executes operation corresponding to the

operation on the computer 3500. Assume that operation

conducted at the terminal device 101 is V, operation to

be conducted on the computer 3500 corresponding to V can

be specified based on information correlating the data

25   of the screen information output by the screen analysis

unit 3501 and the data obtained by converting the format

of the data of the screen information in question by the

screen information conversion unit 3502 (information about which parts of the data before conversion and the data after the conversion correspond to each other).

In another example, the device characteristic detection unit 3506 detects a kind of machine of the terminal device 101, and registered in the conversion rule registration unit 3505 for each kind of the terminal device 101 are rules for converting data of a general-purpose format output by the screen analysis unit 3501 into data of a format suitable for the kind of machine in question. Assume, for example, that a kind of the terminal device 101 is detected being Z and that rules for converting data of screen information from the XML format to a mail format in a case of a terminal device whose kind is Z are registered at the conversion rule registration unit 3505 (that is, in this case, the terminal device 101 whose kind of machine is Z is a terminal device capable of transmitting and receiving mail). In this case, the screen information conversion unit 3502 converts the data of the screen information having the XML format output by the screen analysis unit 3501 into data of the mail format according to the conversion rules for a terminal device of Z kind registered at the conversion rule registration unit 3505. The data of the mail format is transmitted as mail to the terminal device 101 by the screen information transmission unit 3503 and displayed on the screen of

the terminal device 101 similarly to the example shown in Fig. 26.

In a further example, the device characteristic detection unit 3506 detects a processing rate of the terminal device 101, and registered in the conversion rule registration unit 3505 are rules for converting data of a general-purpose format output by the screen analysis unit 3501 according to the processing rate of the terminal device 101. Assume, for example, that a processing rate of the terminal device 101 is detected being $Z1$ and that registered at the conversion rule registration unit 3505 are (1) rules for converting data of screen information from the XML format to the HTML format and (2) rules for deleting part of the screen information when the processing rate is less than $Z2$. In this case, according to the rules (1) and (2) registered at the conversion rule registration unit 3505, the screen information conversion unit 3502 converts the data of the screen information having the XML format output by the screen analysis unit 3501 into data of the HTML format after deleting a part of the data when $Z1<Z2$ and converts all the data of the screen information having the XML format output by the screen analysis unit 3501 into the HTML format when $Z1 = Z2$ or $Z1>Z2$. As can be seen from the foregoing description, the present example reduces load on screen information displaying processing at the terminal device 101 by deleting part

of screen information when the processing rate of the terminal device is low.

In a still further example, the device characteristic detection unit 3506 detects a communication rate of the terminal device 101, and registered in the conversion rule registration unit 3505 are rules for converting data of a general-purpose format output by the screen analysis unit 3501 according to the communication rate of the terminal device 101. Assume, for example, that the communication rate of the terminal device 101 is detected being $Z1$ and that registered at the conversion rule registration unit 3505 are (1) rules for converting data of screen information from the XML format to the HTML format and (2) rules for deleting part of the screen information when the communication rate is less than $Z2$. In this case, according to the conversion rules (1) and (2) registered at the conversion rule registration unit 3505, the screen information conversion unit 3502, similarly to the above case of processing rate detection, converts the data of the screen information having the XML format output by the screen analysis unit 3501 into data of the HTML format after deleting part of the data when $Z1<Z2$ and converts all the data of the screen information having the XML format output by the screen analysis unit 3501 into the HTML format when $Z1 = Z2$ or $Z1>Z2$. As can be seen from the foregoing description, the present

example reduces the volume of data transmission from the computer 3500 to the terminal device 101 by deleting part of screen information when the communication rate of the terminal device is low.

5   In a still further example, the device characteristic detection unit 3506 detects a communication cost of the terminal device 101 per unit volume of data, and registered in the conversion rule registration unit 3505 are rules for converting data of

10   a general-purpose format output by the screen analysis unit 3501 according to a communication cost of the terminal device 101 per unit volume of data. Communication cost of the terminal device 101 per unit volume of data may be directly detectable or may be

15   indirectly detectable from an inherent ID or a kind of machine of the terminal device 101. Assume, for example, that a communication cost of the terminal device 101 per unit volume of data is detected being Z1 and that registered at the conversion rule registration unit 3505

20   are (1) rules for converting data of screen information from the XML format to the HTML format and (2) rules for deleting part of the screen information when the communication cost per unit volume of data is not less than Z2. In this case, according to the conversion rules

25   (1) and (2) registered at the conversion rule registration unit 3505, the screen information conversion unit 3502 converts the data of the screen

information having the XML format output by the screen

analysis unit 3501 into data of the HTML format after

deleting part of the data when $Z1=Z2$ or $Z1>Z2$ and

converts all the data of the screen information having

5   the XML format output by the screen analysis unit 3501

into the HTML format when $Z1<Z2$. In other words, the

present example reduces costs for data transmission from

the computer 3500 to the terminal device 101 by deleting

part of screen information when a communication cost of

10   the terminal device 101 per unit volume of data is high.

In a still further example, the device

characteristic detection unit 3506 detects a

communication cost of the terminal device 101 per unit

time, and registered in the conversion rule registration

15   unit 3505 are rules for converting data of a general-

purpose format output by the screen analysis unit 3501

according to a communication cost of the terminal device

101 per unit time. Communication cost of the terminal

device 101 per unit time may be directly detectable or

20   may be indirectly detectable from an inherent ID or a

kind of machine of the terminal device 101 similarly to

the above-described case of communication cost per unit

volume of data. Assume, for example, that a

communication cost of the terminal device 101 per unit

25   time is detected being Z1 and that registered at the

conversion rule registration unit 3505 are (1) rules for

converting data of screen information from the XML

format to the HTML format and (2) rules for deleting

part of the screen information when the communication

cost per unit time is not less than Z2. In this case,

according to the conversion rules (1) and (2) registered

5   at the conversion rule registration unit 3505, the

screen information conversion unit 3502 converts the

data of the screen information having the XML format

output by the screen analysis unit 3501 into data of the

HTML format after deleting part of the data when $Z1=Z2$

10   or $Z1>Z2$ and converts all the data of the screen

information having the XML format output by the screen

analysis unit 3501 into the HTML format when $Z1<Z2$. In

other words, the present example reduces costs for data

transmission from the computer 3500 to the terminal

15   device 101 by deleting part of screen information when a

communication cost of the terminal device 101 per unit

time is high (because reduction in the volume of data

communicated leads to reduction in a communication time).

In a still further example, the device

20   characteristic detection unit 3506 detects a data format

that can be displayed on the screen of the terminal

device 101, and registered in the conversion rule

registration unit 3505 are rules for converting data of

a general-purpose format output by the screen analysis

25   unit 3501 into data of a format that can be displayed on

the screen of the terminal device 101. Data format that

can be displayed on the screen of the terminal device

101 may be directly detectable or may be indirectly
detectable from an inherent ID or a kind of machine of
the terminal device 101 similarly to the above-described
examples. Assume, for example, that a data format that
can be displayed on the screen of the terminal device
101 is detected being the HTML format and that
registered at the conversion rule registration unit 3505
are rules for converting data of screen information from
the XML format to the HTML format and a plurality of
rules for converting the data into other formats (mail
format etc.) than the HTML format. In this case,
according to the above-described conversion rules
registered at the conversion rule registration unit 3505,
the screen information conversion unit 3502 converts the
data of the screen information having the XML format
output by the screen analysis unit 3501 into data of the
HTML format.

In a still further example, the device
characteristic detection unit 3506 detects program and
script formats executable at the terminal device 101,
and registered in the conversion rule registration unit
3505 are rules for converting data of a general-purpose
format output by the screen analysis unit 3501 into a
program or a script whose format is executable on the
terminal device 101. Formats of a program and a script
executable at the terminal device 101 may be directly
detectable or may be indirectly detectable from an

inherent ID or a kind of machine of the terminal device 101 similarly to the above-described examples. Assume, for example, that a program of a Java format and a script of a Java script format are detected being executable at the terminal device 101 and that registered at the conversion rule registration unit 3505 are rules for converting data of screen information having the XML format into a script of the Java script format. In this case, according to the above-described conversion rules registered at the conversion rule registration unit 3505, the screen information conversion unit 3502 converts the data of the screen information having the XML format output by the screen analysis unit 3501 into a script of the Java script format. This processing is also the same in a case where rules for converting data of screen information having the XML format into a program of the Java format are registered in the conversion rule registration unit 3505.

In a still further example, the device characteristic detection unit 3506 detects a volume of data receivable at one time by the terminal device 101, and registered in the conversion rule registration unit 3505 are rules for converting a volume of data to be transmitted to the terminal device 101 into data whose volume is not more than the volume of data receivable by the terminal device 101 at one time. Volume of data receivable by the terminal device 101 at one time may be

directly detectable or may be indirectly detectable from

an inherent ID or a kind of machine of the terminal

device 101 similarly to the above-described examples.

Assume, for example, that a data format that can be

5   displayed on the screen of the terminal device 101 is

detected being the HTML format and the volume of data

receivable at the terminal device 101 at one time is

detected being Z and that registered at the conversion

rule registration unit 3505 are (1) rules for converting

10   data of screen information from the XML format to the

HTML format and (2) rules for deleting part of the data

of the HTML format such that the volume of data is not

more than Z. In this case, according to the above-

described conversion rules (1) and (2) registered at the

15   conversion rule registration unit 3505, the screen

information conversion unit 3502 converts the data of

the screen information having the XML format output by

the screen analysis unit 3501 into data of the HTML

format and furthermore deletes part of the data having

20   the HTML format such that the volume of data is not more

than Z. In other words, since the terminal device 101 is

capable of receiving a certain fixed volume of data at

one time, reducing the volume of data of screen

information to be transmitted down to not more than a

25   limited volume enables even the terminal device 101

whose volume of receivable data is limited to display

screen information of the computer 3500.

In a still further example, the device
characteristic detection unit 3506 detects a color that
can be displayed on the screen of the terminal device
101, and registered in the conversion rule registration
unit 3505 are rules for converting data of a general-
purpose format output by the screen analysis unit 3501
according to a color that can be displayed on the screen
of the terminal device 101. Color that can be displayed
on the screen of the terminal device 101 may be directly
detectable or may be indirectly detectable from an
inherent ID or a kind of machine of the terminal device
101 similarly to the above-described examples. Assume,
for example, that a data format that can be displayed on
the screen of the terminal device 101 is detected being
the HTML format, that colors that can be displayed on
the screen of the terminal device 101 are a total of 256
colors including black, red and blue and that registered
at the conversion rule registration unit 3505 are (1)
rules for converting data of screen information from the
XML format to the HTML format and (2) rules for using a
color designation tag of the HTML so as to express
information of the same kind of GUI widgets (button,
menu, etc.) by the same color and selecting the color
from the colors that can be displayed on the screen of
the portable terminal 101. In this case, according to
the above-described conversion rules (1) and (2)
registered at the conversion rule registration unit 3505,

the screen information conversion unit 3502 converts the
data of the screen information having the XML format
output by the screen analysis unit 3501 into data having
the HTML format and furthermore a color designation tag

5   of the HTML is used so as to express information of the
same kind of GUI widgets by the same color in the
conversion to the HTML and the color to be used is
selected from among the colors that can be displayed on
the screen of the terminal device 101. Also in a case

10   where the device characteristic detection unit 3506
detects a character font that can be displayed on the
screen of the terminal device 101, a character font that
can be displayed is detected and data of screen
information is converted such that the data is displayed

15   on the screen of the portable terminal 101 using the
detected character font in completely the same manner as
that of the above-described case of the color.

      In a still further example, the device
characteristic detection unit 3506 detects a screen

20   resolution of the terminal device 101, and registered in
the conversion rule registration unit 3505 are rules for
converting data of a general-purpose format output by
the screen analysis unit 3501 according to the screen
resolution of the terminal device 101. Assume, for

25   example, that a data format that can be displayed on the
screen of the terminal device 101 is detected being the
HTML format, that a screen resolution of the terminal

device 101 is detected being W1 pixels in the lateral
direction and H1 pixels in the vertical direction and
that registered at the conversion rule registration unit
3505 are (1) rules for converting data of screen
5 information from the XML format to the HTML format and
(2) rules for deleting part of the screen information
when the screen resolution is less than W2 pixels in the
lateral direction and less than H2 pixels in the
vertical direction. In this case, according to the
10 conversion rules (1) and (2) registered at the
conversion rule registration unit 3505, the screen
information conversion unit 3502 converts the data of
the screen information having the XML format output by
the screen analysis unit 3501 into data of the HTML
15 format after deleting part of the data when W1<W2 and
H1<H2 and otherwise, converts all the data of the screen
information having the XML format output by the screen
analysis unit 3501 into data of the HTML format. In
other words, when a screen resolution of the terminal
20 device 101 is smaller than a fixed size, the present
example suppresses the amount of information displayed
on a terminal device whose screen size is small by
deleting part of screen information. Also in a case
where the device characteristic detection unit 3506
25 detects physical lengths in the vertical and lateral
directions of the screen of the terminal device 101 or
the number of characters that can be displayed in the

vertical and lateral directions within one screen, data of screen information is converted with part of them deleted when a physical length of a screen in the vertical and lateral directions are smaller than fixed

5   values or when the number of characters that can be displayed in the vertical and lateral directions within one screen is smaller than fixed values in completely the same manner as the above-described case of screen resolution.

10   Next, a remote operation system according to a sixth embodiment of the present invention will be described.

Fig. 38 is a block diagram showing a structure of the remote operation system according to the sixth

15   embodiment. The remote operation system of the sixth embodiment is completely the same as the remote operation system of the fifth embodiment in basic operation with the only difference in operation of a screen analysis unit 3801, a screen information

20   conversion unit 3802, a screen information transmission unit 3803, a terminal characteristic detection unit 3804 and a conversion rule registration unit 3805.

In the remote operation system of the sixth embodiment, the screen analysis unit 3801 detects still

25   picture or moving picture being displayed, if it is displayed, within an active window displayed on the current GUI screen of the computer 100. When detecting

still picture or moving picture being displayed, the
screen analysis unit 3801 furthermore extracts display
data of the still picture or the moving picture and
outputs the data together with data of screen

5   information of the XML format to the screen information
conversion unit 3802.

In addition, the terminal characteristic
detection unit 3804 is capable of detecting a data
format of still picture and moving picture that can be

10   displayed on the terminal device 101, and in the
conversion rule registration unit 3805, rules are
registered for converting display data of still picture
or moving picture extracted by the screen analysis unit
into data of the still picture or the moving picture

15   having a format that can be displayed on the terminal
device 101.

In addition to converting data of screen
information of the XML format into data of a format that
can be displayed on the terminal device 101 similarly to

20   the case of the fifth embodiment, the screen information
conversion unit 3802 converts display data of still
picture or moving picture extracted by the screen
analysis unit 3801 into data of still picture or moving
picture having a format that can be displayed at the

25   terminal device 101 according to the rules registered at
the conversion rule registration unit 3805. These pieces
of data are transmitted to the terminal device 101 by

the screen information transmission unit 3803 and displayed on the screen of the terminal device 101.

Assume, for example, that the current screen of the computer 100 is the same as the screen 50 of Fig. 33, on which it is assumed that the picture display window 40 is currently an active window and in the picture display box 3300 on the picture display window 40, still picture such as a photograph or moving picture such as TV is displayed. In this case, the screen analysis unit 3801 detects the picture display window 40 being currently an active window and analyzes information of GUI widgets on the window to output data of the screen information in the XML format, as well as detecting the picture display box 3300 in which still picture or moving picture is displayed existing on the window 40 and extracting and outputting picture data displayed in the picture display box 3300.

The data of the screen information in the XML format and the picture data output by the screen analysis unit 3801 are converted into data whose format can be displayed on the terminal device 101 by the screen information conversion unit 3802 and transmitted to the terminal device 101 by the screen information transmission unit 3803. As a result, the data is displayed on the screen of the terminal device 101 as shown in Fig. 34. The picture data displayed in the picture display box 3400 of Fig. 34 is data obtained by

converting the picture data of the picture display box
3300 shown in Fig. 33. When picture displayed in the
picture display box 3300 is moving picture, picture in
the picture display box 3300 changes with time,

5   according to which change picture in the picture display
box 3400 also changes. In other words, when the screen
analysis unit 3801 detects moving picture display, the
screen analysis unit 3801 continuously extracts data of
picture in the picture display box 3300 in which the

10   moving picture is displayed and continuously outputs the
data to the screen information conversion unit 3802. The
screen information conversion unit 3802 continuously
converts picture data of the moving picture and
furthermore the screen information transmission unit

15   3803 continuously transmits the converted picture data
to the picture display box 3400. In the present
embodiment, the terminal device 101 is a terminal device
capable of displaying the picture display box 3400 and
capable of displaying still picture or moving picture in

20   the picture display box 3400 as well. A data format of
still picture or moving picture that can be displayed in
the picture display box 3400 may not be the same as a
data format of still picture or moving picture displayed
in the picture display box 3300.

25   In the above-described remote operation systems
of the respective embodiments, functions of the screen
analysis unit, the screen information transmission unit,

the operation execution unit and the screen change

detection unit in the computer 100 to be operated and

other functions can be realized not only by hardware but

also by loading a computer program having each function

5   into a memory of a computer processing device. The

computer program is stored in a recording medium 108

such as a magnetic disc and a semiconductor memory. Then,

loading the program from the recording medium into the

computer processing device to control operation of the

10 computer processing device realizes each of the above-

described functions.

Fig. 39 is a block diagram showing one specific

example of a device structure of the computer 100 to be

operated in the present invention.

15 The computer 3900 of the example shown in Fig. 39

is connected to the communication network 102 of the

Internet through the Internet connection device 3912

(modem, terminal adapter, dial-up router, etc.) which is

the communication unit 107. This enables remote

20 operation of the computer 100 from a PHS terminal or the

like through the Internet. The computer is also provided

with a display 3910 as a display device, a keyboard 3909

and a mousse 3911 as input devices.

In the example of Fig. 39, the computer program

25 having the above-described functions of the present

invention is recorded in each of various kinds of

recording media such as a ROM 3902 (Read Only Memory), a

hard disc 3906, a CD 3905 (Compact Disc) and an FD 3908 (Floppy Disc), read into an RAM 3903 (Random Access Memory) and executed by a CPU 3901 (Central Processing Unit). When the program is recorded in the CD 3905, it can be read through a CD drive 3904 and when the same is recorded in the FD 3908, it can be read through an FD drive 3907.

Although the present invention has been described with respect to the preferred embodiments and specific examples in the foregoing, the present invention is not limited to the above-described embodiments and specific examples and can be implemented as variations within a scope of the technical idea.

As described in the foregoing, the remote operation system of the present invention attains the following effects.

Firstly, the system enables even a portable terminal whose display size is small and whose information that can be displayed is a character only to conduct remote operation of a computer, thereby remotely operating arbitrary GUI application software running on the computer to be operated.

Secondly, since a display screen of a computer to be operated is appropriately converted into a hyper-text or a web page displayed by character data, which is transmitted to a user's terminal and whose operation is accepted by the same, the user's terminal needs not to

have a special function for remote operation, so that a computer having the GUI environment can be remotely operated by freely selecting a terminal capable of communication and having a web browser or the like.

5   Thirdly, since from information of a screen of a computer to be operated, data such as a title name of an active window and a name of each item of a menu is obtained and converted into text data of the HTML text or the like and the converted data is notified,

10   notification of detailed data is unnecessary such as a display position and configuration of each window and object, which notification is required in conventional systems, whereby communication costs can be drastically reduced.

15   Fourthly, since data of screen information of a computer to be operated is converted according to characteristics of a terminal device for use in remote operation, terminal devices having various characteristics are allowed to be used in remote

20   operation of a computer. In other words, a terminal device usable for remote operation is not limited to a device having certain specific characteristics.

Although the invention has been illustrated and described with respect to exemplary embodiment thereof,

25   it should be understood by those skilled in the art that the foregoing and various other changes, omissions and additions may be made therein and thereto, without

departing from the spirit and scope of the present
invention. Therefore, the present invention should not
be understood as limited to the specific embodiment set
out above but to include all possible embodiments which

5   can be embodies within a scope encompassed and
equivalents thereof with respect to the feature set out
in the appended claims.